



July 7, 2010

Ms. Demaree Collier
Work Assignment Manager (SR-6J)
Remedial Response Unit No. 1
U.S. Environmental Protection Agency Region 5
77 West Jackson Boulevard
Chicago, IL 60604

**Subject: Technical Review Comments on Operable Unit 1 (OU1),
Site-wide, and Jointly Written Sections of the
“Draft Final Remedial Investigation Report”
Matthiessen and Hegeler Zinc Company Site
LaSalle, LaSalle County, Illinois
Contract No. EP-S5-06-02, Work Assignment No. 015-RSBD-B568**

Dear Ms. Collier:

SulTRAC has reviewed the OU1, site-wide, and jointly written portions of the above-referenced document for the Matthiessen and Hegeler Zinc Company Site in LaSalle, LaSalle County, Illinois. Geosyntec Consultants (Geosyntec) on behalf of Carus Corporation and Carus Chemical Company, the responsible parties for OU1, submitted the document to the U.S. Environmental Protection Agency (EPA) on June 4, 2010. SulTRAC received the hard-copy on June 7, 2010, and reviewed the document. SulTRAC's technical review comments on the document are enclosed.

If you have any questions regarding the review comments, please call me at (312) 443-0550, ext. 21.

Sincerely,

A handwritten signature in cursive script that reads "Jennifer Knoepfle".

Jennifer Knoepfle, Ph.D.
Project Manager

Enclosure

cc: Thomas Harrison, EPA Contracting Officer (letter only)
Ron Riesing, SulTRAC Program Manager (letter only)
Rich Berggreen, Geosyntec Senior Geologist
Keith Tolsen, Geosyntec Senior Toxicologist
Nandra Weeks, Geosyntec Principal
File

ENCLOSURE
TECHNICAL REVIEW COMMENTS ON OPERABLE UNIT 1,
SITE-WIDE, AND JOINTLY WRITTEN SECTIONS OF THE
“DRAFT FINAL REMEDIAL INVESTIGATION REPORT”
MATTHIESSEN AND HEGELER ZINC COMPANY SITE
LASALLE, LASALLE COUNTY, ILLINOIS

(41 Pages)

**TECHNICAL REVIEW COMMENTS ON OPERABLE UNIT 1,
SITE-WIDE, AND JOINTLY WRITTEN SECTIONS OF THE
“DRAFT FINAL REMEDIAL INVESTIGATION REPORT”
MATTHIESSEN AND HEGELER ZINC COMPANY SITE
LASALLE, LASALLE COUNTY, ILLINOIS**

SulTRAC has reviewed the Operable Unit 1 (OU1), site-wide, and jointly written portions of the “Draft Final Remedial Investigation Report” (RI report) for the Matthiessen and Hegeler Zinc Company Site in LaSalle, LaSalle County, Illinois. Geosyntec Consultants (Geosyntec), on behalf of Carus Corporation and Carus Chemical Company, assembled the RI report, which was jointly written by Geosyntec and SulTRAC. Geosyntec submitted the RI report to the U.S. Environmental Protection Agency (EPA) on June 4, 2010. SulTRAC’s technical comments regarding the RI report and the risk assessment (Appendix RA of the RI report) are presented in the general and specific review comments presented below.

RI REPORT COMMENTS

SulTRAC’s general comments on the text, tables, figures, and appendices of the RI report are presented below.

GENERAL COMMENTS ON TEXT

1. In the electronic version of the RI report, section numbers should be hyperlinked at least to the chapter level to allow easy navigation within the report for reviewers and readers. Hyperlinking section numbers to the table of contents also would be helpful.
2. The RI report table of contents should be revised to include Appendix RA, which presents the human health risk assessment (HHRA) and the ecological risk assessment (ERA) for the Matthiessen and Hegeler Zinc Company Site.
3. The final hard-copy version of the RI report should include cover pages either for each grouping of figures, tables, etc., or at the front of each volume.
4. At the Matthiessen and Hegeler Zinc Company Site, the term “bedrock” is defined as Pennsylvanian-aged rock, which includes both shale and limestone. When the term “shale” is used in the text and tables of the RI report, the text and tables should clarify if the term “shale” refers to “bedrock” or otherwise. For example, in Table 2.1.2-1, Table 3.2.3-2, and Appendix G-3-1, the “Geology” columns list both “shale” and “bedrock.” The lithology should be listed generally as simply

“bedrock” or should be listed specifically as “shale bedrock,” “limestone bedrock,” or “shale and limestone bedrock” to eliminate confusion about the lithology type.

5. Throughout the OU1 portions of the RI report, water-bearing zone (WBZ)1 and WBZ2 either are not clearly defined or are defined differently than WBZ1 and WBZ2 for Operable Unit 2 (OU2). This discrepancy is specifically discussed in the review comments on Sections 3, 4, and 6 of the RI report. This discrepancy should be resolved, especially in discussions of site-wide hydrogeology.
6. The term “Site” or “site”, when referring to the Matthiessen and Hegeler Zinc Company Site should be consistently used throughout the RI report.
7. Throughout the RI report, the text, tables, and figures use inconsistent terminology. For example, terms are (1) inconsistent (such as “Slag Pile Area” and “Slag Pile”) and (2) inconsistently capitalized (such as “Slag Pile” and “slag pile”). The text, tables, and figures should be revised as needed to present exactly consistent terminology throughout the RI report. It should be noted that the Slag Pile example noted in this comment is only one of the numerous inconsistencies contained in the RI report.

GENERAL COMMENTS ON TABLES

1. Table notes for all OU2 tables were not included in the electronic or hard-copy versions of the RI report. Table notes for all tables should be included in the final RI report.

GENERAL COMMENTS ON FIGURES

1. OU1, OU2, and the Little Vermilion River (LVR) should be labeled on all figures as appropriate.
2. The RI report figures show a north-south oriented line between the Plant Area and Slag Pile. It is not clear what this line stands for. If the line is intended to show the three different components of OU1 (the Plant Area, LVR, and Slag Pile), the line should be added to the figure legends accordingly. The current legends show that the red boundary lines indicate “OU Boundaries.”
3. For figures measuring 11- by 17-inches, the scale should be adjusted as needed to allow easy reading. For example, Figures 2.1.3-2 and 2.1.3-1 are very difficult to read and should be rescaled. Insets can be used to address this problem, or the figures can be divided to show north and south areas of sampling (for example, Figure 2.1.3-2 can be divided into Figures 2.1.3-2a and b).

4. Overall, capitalization of the figure titles and of the titles listed in the list of Figures in the table of contents is inconsistent. In some titles, every word is capitalized, but in other titles, only the first word is capitalized. The figure titles and the titles listed in the list of Figures should be consistently capitalized.
5. In the figure title blocks and the list of Figures in the table of contents, the phrases “sample locations” and “sampling locations” both are used. The titles should be revised to use “sampling locations” only because “sample locations” can refer to the actual location of a sample (such as a cooler or a laboratory).
6. The date shown in the title blocks of the figures should reflect the date of submission for the RI report.

GENERAL COMMENTS ON APPENDICES

1. Appendix G-2-1, which provides the OU1 boring logs, was incomplete. For example, the boring logs for MW-1, MW-2, MW-306, etc., were not provided. All boring logs should be included.
2. Appendix G-2-2, which provides the OU1 construction logs, was incomplete. For example, the monitoring well construction logs for MW-1 and MW-2 were not provided. All construction logs should be included.

SECTION 1.0 SPECIFIC COMMENTS

1. **Section 1.2.1.1, OU1 Description, Paragraph 1, Page 1-3.** The text states that Carus “mostly” owns the Slag Pile. The text should be revised to clarify if the Slag Pile has other known or unknown owners. Also, the text states that “within the LVR there are 10.5 acres present with slag.” It is not clear if the text should be revised to read “within the Slag Pile Area, there are 10.5 acres present with slag.” This issue should be addressed as needed.
2. **Figure 1.2.1-1, Site Location Map.** The Site Location Map should include the formal Site name (Matthiessen and Hegeler Zinc Company Site) as well as the respective specific areas of OU2 that are called out in the text. Currently, the figure shows only OU1-specific components. For example, the OU2 Rolling Mill, residential area, quarry, and farmland are not shown but should be.

SECTION 2.0 GENERAL COMMENTS

1. To better understand the RI activities at the Matthiessen and Hegeler Zinc Company Site, tables of the following should be included for OU1 because the accompanying data or information all are described to some degree in the Section 2 OU1 text:
 - Phase I and Phase II sample information should be included for all matrices and include the following:
 - Logistical information (sampling date, depths, matrix, locations, identification [ID] numbers, etc.)
 - Analytical information (types of analyses conducted on collected samples)
 - Air sampling data
 - Monitoring well installation details for pre-2007 monitoring wells, Phase I monitoring wells, and Phase II monitoring wells, including which wells were in disrepair, repaired, or abandoned, and citations of appropriate information from Appendix G-2-2
 - Monitoring well water quality summary
2. All Section 2 figures should be coded to show which locations were sampled during Phase I and which were sampled during Phase II. Additionally, some figures are not specifically cited in their corresponding sections. For example, Sections 2.1.1 and 2.1.1.2 should be revised to refer to Figures 2.1.1-1 and 2.1.1-2. All text in Section 2 should be revised as needed to refer to figures that show sampling locations.

SECTION 2.0 SPECIFIC COMMENTS

1. **Section 2.1, OU1 Investigation Activities, Page 2-1, Paragraph 2.** The text should be revised to cite EPA-approved sampling and analysis-type plans submitted on behalf of Carus Corporation and Carus Chemical Company.
2. **Section 2.1, OU1 Investigation Activities, Page 2-1, Paragraph 3, and Page 2-2, Paragraph 3.** Currently, the text refers to both “numbers of samples” and “numbers of sampling locations.” These terms are unclear. Instead, the text and figures should consistently refer to either “number of samples collected,” “number of locations sampled,” or both as applicable.
3. **Section 2.1.1, Soil Investigation, Page 2-2, Paragraph 2.** The text refers to “Figure 2.1.1-X through 2.1.1-X” and “Table 2.1.1-X.” The “X” in these figure and table numbers should be replaced with the correct numbers. Additionally, Section 2.1.1 has only one table, Table 2.1.2-1, which details monitoring well construction. However, the text states, “Table 2.1.1-X summarizes information for

the samples collected...” This text indicates that a table should be included that summarizes sampling information for all samples collected. All tables should be included as applicable, and the text should be revised as needed to correctly refer to the tables.

4. **Section 2.1.1.1, Phase I Soil Investigation (OU1), Page 2-3, Paragraph 3.** The text should be revised to refer to Appendix G-2-1, which contains the OU1 boring logs.
5. **Section 2.1.1, Phase I Soil Investigation (OU1), Sentence 1, Page 2-4, Paragraph 2.** A data table should be created showing the described Slag Pile depths, thicknesses, and volume as well as the underlying natural geology and cover extent. This table could be presented either in Section 2 or Section 3 of the RI report. Currently, neither section contains such a table.
6. **Section 2.1.1, Phase I Soil Investigation, Sentence 2, Page 2-4, Paragraph 2, and Figure 2.1.1-1.** The text lists only three locations (SB-301, SB-303, and SB-305) for slag sampling during Phase I. However, Section 2.1, “OU1 Investigation Activities,” Page 2-1, Paragraph 3, states that solid matrix samples were collected from 10 locations in the Slag Pile Area during Phase I. The text in Sections 2.1.1 and 2.1 should be rewritten as needed to clarify and resolve this apparent discrepancy, and Figure 2.1.1-1 should be revised to indicate Phase I and Phase II color coding consistent with the revised text.
7. **Section 2.1.1, Phase I Soil Investigation, Page 2-4, Paragraph 2, and Figure 2.1.1-1.** The text states that 31 trenches were excavated to evaluate the lateral boundaries of the Slag Pile Area. Figure 2.1.1-1 should be revised to show the locations of these 31 trenches.
8. **Section 2.1.2, Groundwater Investigation, Page 2-5, Paragraph 1, Bullet 2.** The text indicates that background conditions correspond to “bedrock” groundwater conditions. However, background conditions in Quaternary-aged unconsolidated sediments would not correspond to “bedrock” conditions. “Bedrock” is also referred to as Pennsylvanian-aged shales and limestone in this region. Therefore, there are likely two background conditions: “bedrock” conditions and the overlying native Quaternary-aged unconsolidated sediments. The text should be revised as needed to clarify this issue.
9. **Section 2.1.2.2, Phase II Groundwater Investigation (OU1), Page 2-8, Paragraphs 2 and 3, and Appendix G-3-1.** In addition to groundwater samples collected from the wells discussed, it is assumed that water levels also were measured in the two temporary monitoring wells (ISW-001 and ISW-002) during June and August 2009. Paragraph 2 indicates that elevation measurements of both the interstitial water and the river adjacent to each temporary well were taken. The text should be

revised to specifically describe any groundwater elevation measurements taken and should refer to Appendix G-3-1.

Additionally, Appendix G-3-1 presents groundwater levels for temporary monitoring wells ISW-001 and ISW-002 for October 2009 only. Also, Appendix G-3-1 lists locations ISW-001-River and ISW-002-River. The text in Section 2.1.2.2 and the Appendix G-3-1 table should be revised as needed to describe and list specific times that the interstitial groundwater level measurements occurred at ISW-001 and ISW-002 as well as the ISW-001-River and ISW-002-River sampling locations.

Finally, the reviewer assumes that the adjacent ISW-001-River and ISW-002-River sampling locations are for the “river adjacent to each temporary well” as described in Paragraph 2 of Section 2.1.2.2. If this assumption is correct, the text in Appendix G-3-1 should be revised to refer to these sampling locations.

10. **Section 2.1.2.2, Phase II Groundwater Investigation (OU1), Page 2-9, Paragraph 0, and Appendix W.** The list of Appendixes in the table of contents lists Appendix W, but the RI report does not include such an appendix or a table that lists all the sampled monitoring wells and their stabilization parameters. Additionally, as discussed under the Section 2.0 General Comments, Comment No. 1, Bullet 4, the RI report should include a table summarizing the monitoring well water quality. The RI report should be revised as needed either to include Appendix W or delete Appendix W from the list of Appendixes and to include Appendix W or a table that lists all the sampled monitoring wells and their stabilization parameters.
11. **Section 2.1.3.1, Phase I Surface Water and Sediment Investigation (OU1), Page 2-9, Paragraph 1, and Figure 2.1.3-1.** The text indicates that 20 sediment grab samples were collected and that these sampling locations are shown on Figure 2.1.3-1. However, Figure 2.1.3-1 shows 36 “sediment samples” (in the legend), and it is impossible to tell which of these samples were collected during Phase I and which include the 20 grab samples. The figure and text should be revised as needed to address these issues.
12. **Section 2.1.3.1, Phase I Surface Water and Sediment Investigation (OU1), Page 2-10, Paragraph 1, and Figure 2.1.3-2.** This paragraph indicates that an additional 15 sediment samples were collected in the LVR. The text should be revised to indicate that these sediment sampling locations are shown on Figure 2.1.3-2, and the figure should be revised show these locations.

This paragraph also indicates that eight surface water samples were collected in the LVR. The text should be revised to indicate that these sediment sampling locations are shown on Figure 2.1.3-2, and the figure should be revised show these locations. Also, Figure 2.1.3-2 shows only four “surface water sample locations” (in the legend). Either the text should be revised to clarify how the eight water samples were collected from the four locations shown in the figure or this discrepancy should be resolved.

Finally, as detailed in the Section 2.0 General Comments, Comment No. 1, Bullet 1, a table should be included to clarify the sediment and surface water sampling that occurred during Phase I.

13. **Section 2.1.3.1, Phase I Surface Water and Sediment Investigation (OU1), Page 2-10, Paragraph 2.** The text refers to “Table X” and should be revised to refer to the correct table number.
14. **Section 2.1.3.1, Phase I Surface Water and Sediment Investigation (OU1), Page 2-10, Paragraph 6.** The text refers to three staff gauges. These staff gauge locations should be presented on a figure, and the figure should be cited in the text.
15. **Section 2.1.3-2, Phase II Surface Water and Sediment Investigation (OU1), Page 2-12, Paragraph 3, and Figure 2.1.3-1.** The text states that a total of 19 sediment samples were collected in the LVR as shown on Figure 2.1.3-1. However, Figure 2.1.3-1 shows nine sediment samples (indicated by a star in the legend). The figure and the text should be revised as needed to resolve this discrepancy.
16. **Section 2.1.3-2, Phase II Surface Water and Sediment Investigation (OU1), Page 2-12, Paragraph 4, and Figure 2.1.3-2.** The text states that a total of 27 surface water samples were collected from nine locations. However, Figure 2.1.3-2, which purportedly shows all LVR surface water locations, shows only four surface water samples. The figure and the text should be revised as needed to resolve this discrepancy.
17. **Section 2.1.4-1, Phase I Ecological Characterization, Page 2-13, Paragraph 1.** It may be worthwhile to revise the text to note that the Phase I OU1 and OU2 ecological receptor investigations occurred on the same day(s).
18. **Section 2.1.4-1, Phase I Ecological Characterization, Page 2-14, Paragraph 2.** The text describes observed habitat types, water features, etc. The RI report should include a figure, reference (in an appendix), or a habitat evaluation report (if there is one) that contains figures showing the features described in text.

19. **Section 2.1.4-1, Phase I Ecological Characterization, Page 2-15, Paragraph 1.** The text refers to Figure G3-1, which is not included. This discrepancy should be resolved.
20. **Section 2.1.4-2, Phase II Ecological Characterization, Page 2-19, Paragraph 0, Bullets 1 through 4.** The RI report should include a figure, a reference to a report (if there is one), the community assessment, and a discussion of the sampled LVR reaches to accompany the text. In addition, the text should be revised as needed to discuss these items.
21. **Figure 2.3-1, Site-Wide Background Soil Sampling Locations.** The figure should be revised to outline each park area for clarity.

SECTION 3.0 GENERAL COMMENTS

1. The text in Section 3 refers to the Slag Pile several times as the “6-acre slag pile.” However, in previous sections, it is described as occupying 10.5 acres. This discrepancy should be resolved.
2. The text in Section 3.2 discusses monitoring wells and should be revised to clarify that OU1 monitoring wells are being discussed and not OU2 wells because some figures (such as Figures 3.2.3-3 and 3.2.3-4) also show OU2 monitoring wells and data.
3. Sections 3.2.3.3 and 3.2.3.4 contain text indicating that there are not two WBZs but one consistent WBZ. These statements directly conflict with the OU1 presentation of the data (for WBZ1 and WBZ2), the OU2 interpretation of groundwater using the same WBZ1 and WBZ2 definitions and data presentations, and the discussion in Section 3.4, the site-wide interpretation. This issue must be resolved for the OU1 text and with the OU2 interpretation. If necessary, a revised site-wide interpretation of groundwater may be needed. The groundwater interpretation must be consistent across the entire Matthiessen and Hegeler Zinc Company Site.

SECTION 3.0 SPECIFIC COMMENTS

1. **Section 3.1.3, Surface Water Hydrology, Page 3-5.** This section discusses surface water hydrology and seems to include only the general regional hydrology and anthropogenic-influenced surface water at OU1. The text should be revised to also discuss surface water at OU2. Additionally, the text should describe any wetlands, intermittent streams, ponds, seeps, etc., at the Matthiessen and Hegeler Zinc Company Site as well as their interconnectedness and relation to the LVR.

2. **Section 3.1.7, Regional Hydrogeology, Page 3-8, Paragraph 2.** The text should be revised to discuss how many of the 82 wells within the 2-mile-radius of the Site are private use wells, how many are public supply wells, the directions of the wells from the Site, and the current status of the wells if known. The addition of a figure to clarify these issues should be considered.
3. **Section 3.2.1, Soils, Page 3-10, Paragraph 1.** Figure 3.2.1-1 shows Applesriver silt loam (732A and 732B) and DuPage silt loam (3321A) as OU1 soils, but these soils are not described in the text. The text should be revised to discuss these soils.
4. **Section 3.2.3, Hydrogeology.** The text in Section 3.2.3 does not define WBZ1 or WBZ2, which are first discussed in Section 3.2.3.2, Variations in Water Levels. The text in Section 3.2.3 should be revised to define WBZ1 and WBZ2.
5. **Section 3.2.3.1, Hydrogeologic Characteristics, Paragraph 6.** The text in this paragraph first refers to Table 3.2.3-1, Summary of Hydraulic and Conductivity Testing for OU1 Wells. However, the previous five paragraphs all discuss the specific values presented in Table 3.2.3.1. Therefore, Table 3.2.3-1 should be introduced sooner in Section 3.2.3.1. Additionally, Table 3.2.3-1 should be revised to include the lithology of the WBZ so that the hydraulic conductivity and lithology can be compared.
6. **Section 3.2.3.2, Variations in Water Levels, Page 3-16, Paragraph 1.** The text discusses water level variations in OU1 monitoring wells. It would be very helpful to include a table that (1) shows which monitoring wells are located in which WBZ and (2) includes the wells' screened geology.
7. **Section 3.2.3.3, Groundwater Gradients, Recharge, and Discharge, Page 3-18, Paragraph 0.** The text states that "the water levels in the glacial wells are consistent with the water levels in the Pennsylvanian, suggesting these are a single consistent WBZ." As noted in Section 3.0 General Comments, Comment No. 3, this statement contradicts previous text and figures indicating that WBZ1 and WBZ2 are separate. This discrepancy should be resolved.
8. **Section 3.2.4, Summary of Hydrogeologic Conditions, Page 3-19, Paragraph 1.** As noted in Section 3.0 General Comments, Comment No. 3, the text in this section contradicts previous text and figures indicating that WBZ1 and WBZ2 are separate. This discrepancy should be resolved.
9. **Section 3.4.3, Site-wide Hydrogeology, Page 3-35, Paragraph 1, and Figures 3.4.3-1 and 3.4.3-2.** Figures 3.4.3-1 and 3.4.3-2, the site-wide potentiometric maps, were not included with the hard-copy or electronic versions of the RI report. These figures should be included in the final RI report.

10. **Section 3.4.3.1, Hydraulic Conductivity, Page 3-36, Paragraph 0.** The text states that the site-wide WBZ1 wells have a “wide range” of hydraulic conductivity values. However, it is inaccurate to state that the hydraulic conductivity values have a “wide range.” Site-wide, most of the hydraulic conductivity values and all of the OU2 values range from 10^{-2} to 10^{-4} , which indicates sandy silts to silty clays. Only one well, MW-1 at OU1, has a conductivity value of 10^{-1} . (This well is set in slag materials, but it is difficult to determine the lithology because the soil boring and well construction logs seem to be missing from the corresponding appendices.) The text should be revised to state that the WBZ1 hydraulic conductivity values indicate Quaternary-aged unconsolidated materials.
11. **Figures 3.2.3-2 through 3.2.3-5.** These figures show OU1 and OU2 water levels and potentiometric surfaces but should be revised to show only OU1 water levels and potentiometric surfaces discussed in the text. Also, either the figures should show groundwater flow directions or the text should be revised as needed to indicate why groundwater flow directions are not shown in the figures.

SECTION 4.0 GENERAL COMMENTS

1. In Section 4.1, the text does not specify the total number of samples collected and analyzed for each contaminant of interest (COI). The text should be revised to include this information for each medium and investigation area.

Additionally, the text in Section 4.1, which discusses the nature and extent of contamination for OU1 groundwater, does not mention WBZ1 or WBZ2 at all. The text should be revised as needed to indicate the COIs for the WBZ1 and WBZ2 groundwater samples.

Finally, Section 4.1 indicates that no groundwater wells were sampled in the western and northern portions of the Plant Area of OU1. The text should be revised to include a justification for this decision.

2. Many of the samples discussed in Section 4.1 were collected between 1991 and 1994. Significant changes may have occurred to COIs and the sampled media since then, so these results may not be representative of current conditions. The older data can be included in the RI as historic contamination data. However, these data should not be included in discussions of the current nature and extent of contamination. Specific examples of this issue are discussed further in the Section 4 Specific Comments below.

3. The Section 4.1.2 text, tables, and figures indicate sampling depths as “zero ft bgs.” Samples cannot be collected from 0 feet (ft) below ground surface (bgs). The text, tables, and figures should be revised to specify the sampled depth interval (such as 0 to 0.5 or 0 to 0.25 ft bgs).
4. The Section 4 figures frequently show non-detect results. All non-detect results should be removed from the figures so that the detected results are easier to review.

Additionally, the figures contain blue and green symbol colors that are hard to distinguish. These symbol colors should be changed so that the figures are easier to review.

5. The Section 4.1 figures should be revised to show the applicable screening values for each COI (such as the industrial regional screening level [IRSL], residential regional screening level [RRSL], background threshold value [BTV], maximum contaminant level [MCL], and Tapwater Regional Screening Level [RSL]).

SECTION 4.0 SPECIFIC COMMENTS

1. **Section 4.1.1, OU1 Investigation Areas, Page 4-3, Paragraph 1, and Figures 4.1.1-1 and 4.1.1-2.** The text states that the investigation areas are shown on Figures 4.1.1-1 and 4.1.1-2. However, the figures do not show these areas. The figures should be revised to show the investigation areas.
2. **Section 4.1.2, OU1 Soil Results, Page 4-4, Paragraph 1.** The text states that “RI soil sampling results for OU1 for the Plant, Slag Pile, and LVR sampling areas” are discussed in Section 4.1.2. However, no soil samples were collected from the LVR. The text should be revised as needed to resolve this discrepancy.
3. **Section 4.1.2, OU1 Soil Results, Page 4-5, Paragraph 1, and Figure 4.1.2-1.** The text states that the “brown circles indicate the measured concentrations were above the background threshold values (BTVs) but below the RRSLs for at least one COI.” However, Figure 4.1.2-1 shows that the brown circles indicate arsenic concentrations above the IRSL and below the BTV and the pink circles indicate arsenic concentrations above the IRSL and above the BTV. The text and figure should be revised as needed to resolve this discrepancy.
4. **Section 4.1.2.1, Plant Area Soil Results, Page 4-6, Paragraph 4, and Table 4.1.2-5.** The text states that “only seven of the Plant Area shallow soil samples had a manganese concentration greater than the BTV.” However, Table 4.1.2-5 shows that sample C-9 contained manganese at a concentration of

1,530 milligrams per kilogram (mg/kg), which exceeds the shallow soil BTV of 1,527 mg/kg. The text and Table 4.1.2-5 should be revised as needed to resolve this discrepancy.

5. **Figure 4.1.2-3, Table 4.1.2-9, and Pages 4-8 and 4-9.** The text boxes on Figure 4.1.2-3, the data in Table 4.1.2-9, and the text on Pages 4-8 and 4-9 are inconsistent. The figure, table, and text should be revised as needed to resolve all discrepancies.
6. **Table 4.1.2-9 and Figure 4.1.2-3.** Table 4.1.2-9 shows all samples with at least one compound above detection limit. However, sample ID SB-319 is listed on both Table 4.1.2-9 and Figure 4.1.2-3 and the sample has no compounds listed above detection limit. Please either adjust text to state that the sample is included even though all compounds are non-detect or adjust Table 4.1.2-9 and Figure 4.1.2-3 accordingly.
7. **Figure 4.1.2-7, Table 4.1.2-21, and Pages 4-14 through 4-16.** The text boxes on Figure 4.1.2-7, the data in Table 4.1.2-21 and the text on Pages 4-14 and 4-16 are inconsistent. The text states that the data (SVOCs in Slag Pile Area soil) is presented in the text, table, and figure; however the data for each sample is transcribed differently on the table, figure, and text. The figure, table, and text should be revised as needed to resolve all discrepancies.
8. **Section 4.1.2.2, Slag Pile Soil Results, Page 4-14, Paragraph 4, and Table 4.1.2-21.** The text states that three shallow samples (MW-301H, SSI-X103, and SSI-X104) had non-detectable semivolatile organic compound (SVOC) concentrations. However, Table 4.1.2-21 shows that the three samples contained SVOCs at concentrations above the detection limits. The text and table should be revised as needed to resolve this discrepancy.
9. **Section 4.1.3, OU1 Groundwater Results.** The text states that dissolved and total metals OU1 groundwater samples were collected. The text should be revised to explain how and why the dissolved metals groundwater samples were collected.
10. **Section 4.1.3, OU1 Groundwater Results.** Of the 36 groundwater samples collected from the Plant Area, 25 were collected between 1991 and 1994. Additionally, 3 of the 10 Plant Area locations were sampled between 1991 and 1994 only, and no recent samples have been collected. Of the 27 groundwater samples collected from the Slag Pile, 10 were collected between 1992 and 1994. Additionally, 4 of the 11 Slag Pile locations were sampled between 1992 and 1994 only, and no recent samples have been collected. Groundwater is a flowing medium. As noted in the Section 4.0 General Comments, General Comment No. 2, groundwater results 16 to 19 years old may not be

representative of current conditions. These data can be included in the RI report as historic contamination data. However, these data should not be included in discussions of the current nature and extent of contamination. The text should be revised as needed to address this issue and to include a discussion regarding the usability of groundwater data collected from 1991 through 1994.

11. **Table 4.1.3-4 and Figure 4.1.3-3.** The volatile organic compound (VOC) concentrations on Figure 4.1.3-3 are inconsistent with the VOC concentrations listed on Table 4.1.3-4. For example, Figure 4.1.3-3 shows that for MW-A, all compounds were non-detect. However, Table 4.1.3-4 lists dichloromethane at a concentration of 0.26 J microgram per liter ($\mu\text{g/L}$) at MW-A. The table and figure should be revised as needed to resolve all discrepancies.
12. **Table 4.1.3-5 and Figure 4.1.3-4.** The SVOC concentrations on Figure 4.1.3-4 are inconsistent with the SVOC concentrations listed on Table 4.1.3-5. For example, Figure 4.1.3-4 shows that for MW-1, all compounds were non-detect. However, Table 4.1.3-5 lists di-n-butylphthalate at a concentration of 2.0 J $\mu\text{g/L}$ at MW-1. The table and figure should be revised as needed to resolve all discrepancies.
13. **Section 4.1.3.2, Slag Pile Groundwater Results, Page 4-22, Paragraph 1.** The text states that “groundwater samples from the Slag Pile Area were not analyzed for pesticides and PCBs.” The text should be revised to explain why these samples were not analyzed for pesticides or polychlorinated biphenyls (PCB).
14. **Section 4.1.3.2, Slag Pile Groundwater Results, Page 4-24, Paragraph 5.** The text indicates that in January 2008, two groundwater samples were collected from the Slag Pile Area (one from MW-2 and one from MW-322H) and analyzed for VOCs. No other samples from the Slag Pile Area were analyzed for VOCs. Therefore, less than 10 percent of the samples from the Slag Pile Area were analyzed for VOCs. The text should be revised to explain why so few samples from the Slag Pile Area were analyzed for VOCs.
15. **Section 4.1.3.2, Slag Pile Groundwater Results, Page 4-24, Paragraph 6.** The text indicates that in January 2008, two groundwater samples were collected from the Slag Pile Area (one from MW-2 and one from MW-322H) and analyzed for SVOCs. No other samples from the Slag Pile Area were analyzed for SVOCs. Therefore, less than 10 percent of the samples from the Slag Pile Area were analyzed for SVOCs. The text should be revised to explain why so few samples from the Slag Pile Area were analyzed for SVOCs.

16. **Section 4.1.4.1, OU1 Sediment and Surface Water Results, and Table 4.1.4-4.** The table shows that all six of the sediment samples from the Slag Pile Area holding pond were collected between 1991 and 1994. More recent samples have not been collected. Conditions in the holding pond likely have changed in the last 16 to 19 years. As noted in the Section 4.0 General Comments, General Comment No. 2, sediment results 16 to 19 years old may not be representative of current conditions. These data can be included in the RI report as historic contamination data. However, these data should not be included in discussions of the current nature and extent of contamination. The text in Section 4.1.4 should be revised as needed to address this issue and to include a discussion regarding the usability of sediment data collected from 1991 through 1994.
17. **Section 4.1.4, OU1 Sediment and Surface Water Results, Page 4-25, Paragraph 2, and Figures 4.1.4-1 through 4.1.4-11.** The text states that red symbols on Figures 4.1.4-1 through 4.1.4-11 indicate sediment contaminant concentrations exceeding the IRSLS. However, none of the figures contain any red symbols. The text and figures should be resolved as needed to resolve this discrepancy.
18. **Section 4.1.4.1, Slag Pile Sediment and Surface Water Results, Page 4-25.** The title of Section 4.1.4.1 is “Slag Pile Sediment and Surface Water Results,” but the text and associated tables do not address any Slag Pile surface water results. The text and associated tables should be revised as needed to resolve this discrepancy.
19. **Section 4.1.4.1, Slag Pile Sediment and Surface Water Results, Page 4-26, Paragraph 1, and Table 4.1.4-3.** The text states that Table 4.1.4-3 compares sediment sample concentrations to IRSLS. However, the table does not compare sediment results to the IRSLS. The text and table should be revised as needed to resolve this discrepancy.
20. **Section 4.1.4.1, Slag Pile Sediment and Surface Water Results, Page 4-27, Paragraph 7, and Table 4.1.4-4.** The text refers to cyanide results, but Table 4.1.4-4 does not include any cyanide results. The text and table should be revised as needed to resolve this discrepancy.
21. **Section 4.1.4.1 Slag Pile Sediment and Surface Water Results, Page 4-28, Paragraph 1, and Table 4.1.4-6.** The text states, “All analytes listed in Table 4.1.4-6 were detected at concentrations above analytical method detection limits in at least one sample, or their respective screening values were above their analytical method detection limits.” However, Table 4.1.4-6 shows results for samples having analyte screening values below their analytical method detection limits. The text and table should be revised as needed to resolve this discrepancy.

22. **Figure 4.1.4-7, Total Metals in the Little Vermilion River Surface Water.** The text boxes on this figure list analytes multiple times for the same sampling locations. The figure should be revised to list analytes only once for each sampling location.
23. **Section 4.1.4.2, LVR Sediment and Surface Water Results, Page 4-31, Paragraph 5.** The text states that dissolved and total metals surface water samples were collected from the LVR. The text should be revised to explain how and why the dissolved metals surface water samples were collected.
24. **Section 4.1.4.2, LVR Sediment and Surface Water Results, Page 4-32, Paragraph 3, and Table 4.1.4-11.** The text says that “aluminum concentrations in all LVR sediment samples were below its screening value.” However, Table 4.1.4-11 shows the aluminum screening value as “NS”, which is defined as “no applicable standard”. The text and table should be revised as needed to resolve this discrepancy.
25. **Section 4.1.4.2, LVR Sediment and Surface Water Results, Page 4-33, Paragraph 4, and Table 4.1.4-11.** The text says that “iron concentrations in all LVR sediment samples were below its screening value. However, Table 4.1.4-11 shows the iron screening value as “NS”, which is defined as “no applicable standard”. The text and table should be revised as needed to resolve this discrepancy.
26. **Section 4.1.4.2, LVR Sediment and Surface Water Results, Page 4-34, Paragraph 1, and Table 4.1.4-11.** The text says that “selenium concentrations in all LVR sediment samples were below its screening value.” However, Table 4.1.4-11 shows the selenium screening value as “NS”, which is defined as “no applicable standard”. . The text and table should be revised as needed to resolve this discrepancy.
27. **Section 4.1.4.2, LVR Sediment and Surface Water Results, Page 4-34, Paragraph 7, and Table 4.1.4-12.** Table 4.1.4-12 shows that results for two samples (collected from one surface water sampling location) exceed the ESV for cyanide. However, the text discussing the LVR surface water results does not mention cyanide. The text and table should be revised as needed to resolve this discrepancy.
28. **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-38, Paragraph 4, and Figure 4.1.5-3.** The text states that Figure 4.1.5-3 shows metals concentrations above the IRSLS. However, the figure does not show any results above the IRSLS. The text and figure should be revised as needed to resolve this discrepancy.

29. **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-39, Paragraph 3, and Figure 4.1.5-5.** Figure 4.1.5-5 shows wells and borings up to 300 feet away from the cross-section line A-A'. The text says that this approach is "standard protocol for projecting wells onto a cross-section." However, the cross-section is not clear with the wells at the toe of the Slag Pile projected onto it. The elevation difference between the top and toe of the Slag Pile is significant. Wells located at the toe of the Slag Pile should be removed from this cross-section, and a new cross-section should be created showing these wells at the toe of the Slag Pile. In addition, the text should be revised as needed to discuss the revised cross-sections.
30. **Figures 4.1.5-5 through 4.1.5-12.** These figures should be revised to show groundwater elevations, especially on the cross-sections that show analyte concentrations in groundwater when there are multiple zones of groundwater, confined or perched aquifers, etc.
31. **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-40, Paragraph 1, and Figure 4.1.5-7.** The text states that groundwater containing lead at concentrations above the MCL is limited to wells completely screened in the slag material. However, Figure 4.1.5-7 shows multiple wells screened in unconsolidated native media with groundwater lead concentrations above the lead MCL. The text and figure should be revised as needed to resolve this discrepancy.
32. **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-40, Paragraph 1, and Figure 4.1.5-7.** Figure 4.1.5-7 shows ISW-002 screened in the unconsolidated native media. The text states that Figure 4.1.5-7 shows ISW-002 screened in bedrock, but the figure is distorted because of the projection, and the well actually is screened in slag. If a projection causes the figure to be incorrect, then the projection should not be used. The text and figure should be revised as needed to address this issue.
33. **Section 4.1.5.1, Vertical Extent of Metal Contamination in Soil and Groundwater, Page 4-42, Paragraph 1, and Figure 4.1.5-12.** Figure 4.1.5-12 shows SB-308 and P-18 as co-located. The text says that they are adjacent locations and that zinc therefore has low soil mobility because the zinc detected in SB-308 was not detected in groundwater samples from P-18. However, the two locations are actually about 200 feet apart. The text should be revised to note the distance between these locations and to discuss the mobility of zinc in light of this distance, and Figure 4.1.5-12 should be revised to show that the two locations are not co-located but about 200 feet apart.
34. **Section 4.1.5.5, Vertical Extent of Contamination in Soil and Groundwater, Pages 4-37 through 4-44.** The text does not discuss the vertical extent of sediment contamination, while in Section 4.1.6

the horizontal extent of sediment is characterized. In addition, all sediment samples were collected from 0 to 0.667 ft bgs. Sediment samples from deeper intervals should be collected for remediation purposes. The text should be revised as needed to address these issues.

35. **Section 4.1.6.2, Horizontal Extent of Contamination in Groundwater, Paragraph 6, Page 4-51.**

The text states that that horizontal extent of VOCs in groundwater in the Plant Area has been identified. However, no groundwater VOC samples were collected from the northern and western portions of the Plant Area. VOCs are COIs along the southern border of OU2, which means that they likely are present across the boundary in OU1. The text should be revised to state that additional groundwater samples should be collected from the western and northern portions of the Plant Area and analyzed for VOCs.

36. **Section 4.1.6.3, Horizontal Extent of Contamination in Sediment and Surface Water, Page 4-59, Paragraph 3.**

The text states “that there may be other sources of nickel impact upstream of OU1.” There are additional nickel exceedances of the screening values upstream of OU1. The text should be revised to include these other potential nickel sources.

37. **Section 4.3.1.1, OU1 Soil Results, Page 4-261, Paragraph 2.** The text states that “arsenic, cadmium, lead, manganese, lead, and zinc” were the metals most frequently detected at concentrations above screening values in all OU1 soil samples. Lead is listed twice and should only be listed once. Additionally, text in Section 4.1.2 does not include cadmium or zinc in the list of most frequently detected analytes at concentrations above screening values. The text in Sections 4.3.1.1 and 4.1.2 should be revised as needed to resolve these discrepancies.

38. **Section 4.3.1.2, OU1 Groundwater Results, Page 4-262, Paragraph 2.** The text states that “arsenic, cadmium, manganese, and zinc” were the metals most frequently detected at concentrations above screening values in all OU1 groundwater samples. Text in Section 4.1.3 does not include zinc in the list of most frequently detected analytes at concentrations above screening values. However, chromium (total) and cobalt are listed in Section 4.1.3. The text in Sections 4.3.1.2 and 4.1.3 should be revised as needed to resolve these discrepancies.

39. **Section 4.3.1.3, OU1 Sediment and Surface Water and Sediment Results, Page 4-263, Paragraph 1.** The text states that “arsenic, cadmium, copper, lead, nickel, silver, and zinc” were the metals most frequently detected at concentrations above screening values in all OU1 sediment samples. Text in Section 4.1.4 does not include silver in the list of most frequently detected analytes at concentrations above screening values. However, chromium (total) and mercury are listed in

Section 4.1.4. The text in Sections 4.3.1.3 and 4.1.4 should be revised as needed to resolve these discrepancies.

40. **Section 4.3.3.1, Border Areas Summary, Page 4-268, Paragraph 4.** The text states that “manganese is the only contaminant in addition to arsenic that also exceeds the BTV in addition to the RRS� and IRS�.” The BTVs for all contaminants other than arsenic and manganese are less than the RSLs and are therefore exceeded whenever an RSL is exceeded. The text should be revised as needed to address this issue.
41. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-269, Paragraph 1.** The text incorrectly refers to Figure 4.3.3-1 for border area monitoring wells. The text should be revised to refer to Figure 4.3.3-2.
42. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-270, Paragraph 1, and Figure 4.3.3-2.** The text lists MW18, MW19, and MW22 at 40, 175, and 380 ft, respectively, from the LVR. According to Figure 4.3.3-2, MW19 appears to be further from the LVR than MW22. The text and figure should be revised as needed to address this issue. Additionally, the text does not discuss the distance of MW08 from the LVR. The text should be revised as needed to address this issue.
43. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-270, Paragraph 1.** The text states, “All four OU2 monitoring wells are screened in WBZ2.” This statement is incorrect – MW08 is screened in WBZ1. The text should be revised accordingly.
44. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-270, Paragraph 2.** The text incorrectly refers to Table 4.3.3-2 for analytical results for wells along the border areas. The text should be revised to refer to Table 4.3.3-3.
45. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-270, Paragraph 4.** The text incorrectly refers to Table 4.3.3-2 for contaminants present in groundwater border area wells. The text should be revised to refer to Table 4.3.3-4.
46. **Section 4.3.3.2, Border Areas Groundwater Summary, Page 4-271, Paragraph 1, and Tables 4.1.3-1 and 4.1.3-8.** The text states, “The following wells in the Slag Pile Area of OU1 did not show any exceedances of the total or dissolved metals: P15A, MW301H, MW301S, MW303S, MW305H, MW305S, MW305R, MW320H.” However, Table 4.1.3-1 does not list wells P15A, MW301H, MW301S, MW303S, MW305S, MW305R, and MW320H as having *any* historical data. Therefore, there is no record that these wells were ever sampled. In addition, according to Table 4.1.3-8, the

manganese results for MW305H exceed the Tapwater RSL. The text and Tables 4.1.3-1 and 4.1.3-8 should be revised as needed to resolve these discrepancies.

SECTION 5.0 GENERAL COMMENTS

1. The introduction of Section 5 should provide a clear discussion of the difference between the terms “contaminants of interest (COI)” used in the presentation of the Site characterization results in Sections 4 and 5 and “contaminants of potential concern (COPC)” discussed in the risk assessments. It is important that the introductory sections of Sections 4 and 5 (as well as the HHRA and ERA) make very clear the distinction between the COIs discussed in Sections 4 and 5 (contaminants at concentrations exceeding one or more screening levels) and the COPCs discussed in the risk assessments (contaminants selected based on an EPA-mandated risk assessment procedure). The discussions of COIs should be consistent in Sections 4 and 5, and the COIs discussed in Section 5 should be checked to ensure they include all risk and hazard drivers discussed in the risk assessments.
2. The constituents listed as COIs should be checked for consistency. For example, the COIs are inconsistent between Tables 4.3.1-1, 4.3.2-1, 5.1-1, and 5.1.2-1; the bulleted list of COIs in Section 5.3; and relevant text throughout Section 5.
3. Additional explanation of the organization and content of the subsections would be helpful. Currently, the opening paragraphs and sentences of many sections and subsections do not adequately define the content of the following text. For example, some sections discuss inorganic contaminants, some discuss organic contaminants, some discuss both, some discuss single contaminants, and some discuss groups of related contaminants. If the title of a particular section does not make the content of the section clear (as is the case for Section 5.1.2.1, Inorganic Partitioning, and Section 5.3.1.1, Aluminum, among others), then the introductory sentences must do so. In particular, corrections must be made to the introductory paragraph of Section 5.3, which states that the section discusses inorganic contaminants. This statement is true for Sections 5.3.1 and 5.3.6 but not for Sections 5.3.2 through 5.3.5, which discuss organic contaminants.

SECTION 5.0 SPECIFIC COMMENTS

1. **Section 5.3.1.1, Expected Chemical Fate and Transport – Aluminum, Page 5-8, and Table 5.5.2-1.** This section discusses the fate and transport of aluminum, including its chemistry in acidic to neutral water solutions. Although there is little evidence of alkaline conditions at the Site as shown in Table 5.5.2-1, some remedial technologies do result in considerably alkaline conditions. Therefore,

the text should be revised to discuss the fact that in alkaline solutions, the soluble tetrahydroxyaluminum ion $\text{Al}(\text{OH})_4^-$ forms, and similar revisions should be made to Table 5.1.2-1 as needed.

2. **Section 5.3.1.13, Expected Chemical Fate and Transport – Manganese, Page 5-17, and Table 5.1.2-1.** This section discusses the fate and transport of manganese. However, the text barely mentions the oxidation states Mn(VII) (permanganate) and Mn(VI) (manganate). In 1915, the Carus Chemical Company began producing potassium permanganate by electrolytic oxidation of alkaline manganate solutions or other strong oxidation means and continues to produce potassium permanganate and related compounds. Therefore, these highly oxidized manganese species may have been released to the environment. Both manganate and permanganate are sufficiently strong oxidizers and likely have been reduced through reactions with soil components, but the text should be revised to discuss this aspect of manganese chemistry, and Table 5.1.2-1 should be revised as needed to include this information.
3. **Section 5.3.2, Expected Chemical Fate and Transport – VOCs, Page 5-22, and Table 4.3.2-1.** The first sentence in this section should refer to Table 4.3.2-1. Additionally, the last sentence on this page lists eight VOCs as detected above screening levels in OU2 but does not indicate which media the VOCs were detected in. The text should be revised to provide this information. Also, Table 4.3.2-1 lists only chloroform, trichloroethene, and vinyl chloride as the VOCs present in the OU2 summary of results. The VOCs listed in Table 4.3.2-1 and discussed in the text in this section must be checked for consistency and corrected as appropriate to resolve discrepancies. Finally, Bullet 4 and the second sentence of Section 5.3.2 incorrectly refers to “cis-1,2-dichloroethane.” Apparently, the text should be revised to refer to cis-1,2-dichloroethene (DCE).
4. **Section 5.3.3, Expected Chemical Fate and Transport – SVOCs, Page 5-28.** The last paragraph on this page discusses polycyclic aromatic hydrocarbons (PAH). PAHs include acenaphthene, acenaphthylene, and naphthalene, but the list of relevant PAHs in this paragraph omits these three compounds. In addition, the list of PAHs includes hexachlorobenzene, which is not typically considered a PAH by any definition. Finally, the heterocyclic tricyclic aromatic compound carbazole is not included in the list, although most environmental chemists would include it as a PAH because its relevant chemistry is very similar to tricyclic PAHs such as anthracene. The text and associated tables should be revised as needed to address these issues.

5. **Section 5.3.5, Expected Chemical Fate and Transport – Pesticides, Page 5-32.** This section discusses pesticides, and the third paragraph on this page refers to certain of the selected pesticides as “organochlorine pesticides.” However, all of the pesticides discussed in this section and listed in Table 5.1-1 are organochlorine compounds. The text should be corrected as needed.
6. **Section 5.4.1.1, SEP Results (OU1), Pages 5-37 and 5-38, Tables 5.4.1-1 and 5.4.1-2, and Figures 5.4.1-1 through 5.1.4-7.** This section, Tables 5.4.1-1 and 5.4.1-2, and Figures 5.4.1-1 through 5.4.1-7 present the results of the sequential extraction procedure (SEP) studies. On Page 5-38 the text describes Step 5 of the sequence, which determines the “Organic Phase.” However, the tables and figures call this Step 2 (“Organic Fraction”). The organic fraction determination probably is the fifth step because it involves the use of the strong oxidizer hypochlorite under alkaline conditions. In addition, such alkaline hypochlorite oxidation is usually a late step in the many versions of the SEP discussed in scientific literature. The text, tables, and figures should be revised as needed to resolve this discrepancy and should all reflect the actual procedures used in the SEP studies.
7. **Section 5.4.1.2, SPLP Results (OU1), Page 5-45.** The introduction paragraph in this section contains a typographical error (“A.”) in the last line. The text should be corrected to eliminate this error.
8. **Section 5.4.2, Potential Migration of Contaminants in Groundwater (OU1), Page 5-49.** This section contains very little discussion of contaminant migration in groundwater. For example, the text should provide some discussion of whether groundwater contaminants are expected to migrate horizontally toward the LVR, vertically to deeper WBZs, or both. In addition, the text incorrectly refers to “cis-1,2-dichloroethane” and apparently should refer to cis-1,2-DCE instead.
9. **Tables 5.1-1, 4.3.1-1, and 4.3.2-1, and Section 5.** Table 5.1-1 requires careful proofreading because it contains obvious errors. For example, the molecular weight of ethylbenzene has an extra digit. In addition, the first contaminant listed in Table 5.1-1 is 1,2-dichloroethane (DCA), but the fifth contaminant listed is cis-1,2-DCA. The latter compound does not exist, although it is listed in Table 4.3.1-1 and also discussed in various sections of the text (such as Sections 5.3.2 and 5.4.2 for example). It is assumed that all references in the text and tables to cis-1,2-DCA are typographical errors and should actually be to cis-1,2- DCE. If this assumption is correct, the text (especially in Section 5.3.2) and tables must be corrected as needed. For example, in Table 5.1-1, the molecular weight of cis-1,2-DCE is two units less than that of 1,2-DCA. Furthermore, several compounds listed in Table 5.1-1 are not included in either Table 4.3.1-1 or Table 4.3.2-1, including 1,2-DCA; benzene;

bromodichloromethane; ethylbenzene; tetrachloroethene; and xylene. Finally, Table 4.3.1-1 includes acenaphthene, acenaphthene, and carbazole as COIs, but Table 5.1-1 does not list these COIs. The tables should be revised as needed to resolve all discrepancies.

10. **Tables 5.1.2-1, 4.3.1-1, and 4.3.2-1.** This table omits selenium, silver, and cyanide, all of which are listed as COIs in Table 4.3.1-1, as well as asbestos, which is listed in Table 4.3.2-1. The lists of contaminants in the Section 4 and Section 5 tables must be consistent.

SECTION 6.0 GENERAL COMMENTS

1. The text in Section 6 refers to the Slag Pile several times as the “6-acre slag pile.” However, in other sections, it is described as occupying 10.5 acres. This discrepancy should be resolved.
2. Section 6 appears to be a summary of previous sections of the RI report. In light of this fact, the text should be revised as needed to address all comments on the previous sections. Therefore, all revisions to Sections 3, 4, and 5 should be reflected in this section as well.

SECTION 6.0 SPECIFIC COMMENTS

1. **Section 6.1.1.1, Surface Features of OU1, Page 6-2, Paragraph 0.** The Slag Pile is referred to as the “17.7-acre slag pile.” However, in other sections, it is described as occupying 10.5 and 6 acres. The correct area of the Slag Pile should be used consistently throughout the report.
2. **Section 6.1.1.3, Hydrogeology of OU1, Page 6-4, Paragraph 0, Bullets 1 and 2.** This bulleted list appears to be the first time that WBZ1 and WBZ2 are defined specifically for OU1. This definition should appear much earlier in the report, preferably in Section 3.0, when the OU1 hydrogeology is introduced. As described in the site-wide hydrology section in Section 3.0 and for OU2, it was assumed that WBZ2 consists only of bedrock geology and that WBZ1 includes all Quaternary-aged unconsolidated materials (till, soil, and fill). However, this bulleted definition of each WBZ indicates that OU1 includes the Quaternary-aged till deposit (the Lemont Formation) as part of WBZ2. This definition dramatically differs from the OU2 and site-wide hydrogeology discussions and would significantly impact the site-wide groundwater interpretation. This discrepancy must be resolved throughout Section 6 (including the discussion of groundwater flow in WBZ2 on Page 6-5) as well in the following sections: (1) Section 3.2.3, where the WBZs should be first identified (and subsequently be consistent with the OU2 [Section 3.3.3] and site-wide [Section 3.4.3] discussions); (2) Section 4, where groundwater data should be described according to WBZ; and (3) Section 5, which discusses the fate and transport in each WBZ.

3. **Section 6.1.1.3, Hydrogeology of OU1, Page 6-4, Paragraph 1.** The phrase the “absence of aquitards” seems to indicate that the groundwater system effectively is a single system. As noted in the Section 3.0 General Comments, General Comment No. 3, this statement contradicts previous text and figures describing WBZ1 and WBZ2. Vertical movement of groundwater between WBZ 1 and WBZ 2 is possible, indicating some hydraulic connectivity. However, it is not clear that groundwater is present in a single unit. The text should be revised as needed to resolve this discrepancy.
4. **Section 6.1.1.3, Groundwater Flow in WBZ1, Page 6-4, Paragraph 1.** The text refers to Figures 6.1.1-2 and 6.1.1-3. However, no such figures are included in the electronic or hard-copy of the RI report, and these figures are not listed in the list of Figures in the table of contents. Either the text and list of Figures should be revised to eliminate the reference to these figures, or the figures should be included in the final RI report.
5. **Section 6.1.1.3, Groundwater Flow in WBZ1, Page 6-4, Paragraph 3.** The pronounced groundwater gradients from the Slag Pile and from the bedrock wells are described as “mimicking” each other. Therefore, the text suggests that groundwater is travelling along the slag/bedrock interface. It is unclear how the similar gradients relate to the location and depth of groundwater. The text should be revised to clarify this issue.

SECTION 7.0 GENERAL COMMENT

1. Section 7 should be revised as necessary to incorporate any changes made to the HHRA (Appendix RA) as the result of comments on the HHRA.

SECTION 8.0 GENERAL COMMENT

1. Section 8 should be revised as necessary to incorporate any changes made to the ERA (Appendix RA) as the result of comments on the ERA.

SECTION 8.0 SPECIFIC COMMENTS

1. **Section 8.1.1, OU1 Screening Level Ecological Risk Assessment (Steps 1 and 2), Page 8-4, Paragraph 3, Bullet 2.** This bullet provides the rationale for not conducting a baseline ERA for the Slag Pile at OU1. The last statement states that the physical substrate creates a poor habitat for ecological receptors. Although the substrate is not ideal, large portions of the Slag Pile Area are vegetated and support a number of ecological receptors. In addition, these portions of the Slag Pile contain complete exposure pathways. Either the last sentence in this bullet should be deleted or else

text should be added to note that although portions of the Slag Pile are poor habitat, other areas contain established vegetation and exposure of ecological receptors is occurring and will continue to occur in these areas.

2. **Section 8.1.2.1, Baseline Problem Formulation (Step 3), Page 8-6, Paragraph 2.** The text should be revised to define the acronym ESL.

SECTION 9.0 GENERAL COMMENTS

1. Section 9.3 should be revised as necessary to incorporate any changes made to the HHRA (Appendix RA) as the result of comments on the HHRA.
2. Section 9.4 should be revised as necessary to incorporate any changes made to the ERA (Appendix RA) as the result of comments on the ERA.
3. The text in Section 9.5.2 and Table 9.5.1-1 summarizing the OU1 data limitations and uncertainties should be revised to include the data limitations mentioned in the comments on previous sections, including the data limitations summarized below.
 - The detection limits of some VOCs, PCBs, and pesticides are above screening values.
 - Many soil, sediment, groundwater, and surface water results are for samples collected and analyzed between 1991 and 1994. More recent data should be used.
 - All Slag Pile surface water results are for samples collected and analyzed between 1991 and 1994. More recent data should be used.
 - The small sample group numbers (such as two SVOC samples for Slag Pile groundwater) for some media and analytes are not adequate to allow full characterization of the nature and extent of contamination.

SECTION 9.0 SPECIFIC COMMENTS

1. **Section 9.1.1, OU1 Nature and Extent of Contamination.** This section does not include summaries of the surface water or Slag Pile sediment results. This section should be revised to include these summaries.
2. **Section 9.1.1, OU1 Nature and Extent of Contamination, Page 9-1, Paragraph 3.** The text states sampling before the RI was conducted “from 1992 through 1994.” Sample results from 1991 are included in the Section 4.1 discussion and the Section 4.1 tables and figures. The text, tables, and figures should be revised as needed to resolve this discrepancy.

3. **Section 9.1.1, OU1 Nature and Extent of Contamination, Page 9-2, Paragraph 1.** The text states that “impacted groundwater was evident in both WBZ1 and WBZ2.” However, the nature and extent discussion in Section 4.1 never discusses groundwater in terms of these WBZs. The text should be revised as needed to resolve this discrepancy.
4. **Section 9.1.1, OU1 Nature and Extent of Contamination, Page 9-2, Paragraph 1.** The text lists the COIs based on the LVR sediment sample results. However, cyanide is not listed as a COI. The text in Section 4.1.4.2, Page 4-34, notes that cyanide was detected in LVR sediment at concentrations above its screening value. The text should be revised as needed to resolve this discrepancy.
5. **Section 9.1.2, OU1 Contaminant Fate and Transport, Page 9-2, Paragraph 1.** Text states that “no airborne contamination was observed during the investigation of OU1.” However, there is no evidence that any air samples were collected from OU1, and Section 4.1 does not discuss air sampling. Either this statement should be deleted or the text should be revised to indicate the source of this information.
6. **Section 9.3.3, Site Summary, Page 9-11, Paragraph 3, and Table RA-2-1.** This section summarizes the potential cumulative risks and hazards from OU1 and OU2 and refers to “Table RA-X.” This table is Table RA-2-1. Table RA-2-1 should be included in the RI report also and not only in Appendix RA. Therefore, the table should be renumbered as an RI report table and added to the list of Figures in the table of contents, and the text in this section should be revised to refer to the correct table number.
7. **Section 9.4.1, OU1 ERA Summary, Page 9-12, Paragraph 1, Bullet 2.** This bullet provides the rationale for not conducting a baseline ERA for the Slag Pile at OU1. The last statement states that the physical substrate creates a poor habitat for ecological receptors. Although the substrate is not ideal, large portions of the Slag Pile Area are vegetated and support a number of ecological receptors. In addition, these portions of the Slag Pile contain complete exposure pathways. Either the last sentence in this bullet should be deleted or else text should be added to note that although portions of the Slag Pile are poor habitat, other areas contain established vegetation and exposure of ecological receptors is occurring and will continue to occur in these areas.

APPENDIX RA

APPENDIX RA TABLE OF CONTENTS SPECIFIC COMMENTS

1. **Table of Contents, Tables, Section 2.0, Page x.** The list of Tables in the table of contents incorrectly identifies the table titled “Risk and Hazard Summary – Adult Trespasser, OU2 Exposure Area 3, RME” as Table RA-S2-31.RME. The list should be revised to refer to Table RA-S2-30.RME.
2. **Acronyms and Abbreviations, Page xvi.** The acronyms “ASO” and “CSO” are used in the text (see Page 2-16). However, these acronyms are not defined in the text or in the list of Acronyms and Abbreviations. The text should be revised as needed to define ASO and CSO on their first occurrence, and the list of Acronyms and Abbreviations should be revised to provide these definitions.

APPENDIX RA SECTION 1.0 SPECIFIC COMMENTS

1. **Section 1.2.3.1.3, Page 1-9, Paragraph 1.** Bullet 3 states that “several SVOCs were above SVs in sediment samples from the Slag Pile and the LVR.” Bullet 3 should be revised to identify the specific SVOCs. Similarly, Bullet 5 states, “Concentrations exceeded SVs for seven (7) of these pesticides.” Bullet 5 should be revised to identify the specific pesticides.
2. **Section 1.2.4, Page 1-18, Paragraph 2.** The last sentence of this paragraph states, “(Note: the contribution of Site groundwater to the overall flow of the LVR has not been determined and may be inconsequential.)” Because the contribution of Site groundwater to the overall flow of the LVR has not been determined, this contribution could be significant. Therefore, the note should be revised to delete the phrase “and may be inconsequential.”
3. **Section 1.2.5.1, Page 1-20, Paragraph 1, Bullet 1.** Bullet 1 describes the Carus Plant exposure area. The last sentence in this bullet begins “The Carus Plant is border to the north by OU2 . . .”. This phrase should be revised to read “The Carus Plant is bordered to the north by OU2 . . .”

APPENDIX RA SECTION 2.0 GENERAL COMMENT

1. In most cases, the text presents and discusses cumulative cancer risks and hazard indices (HI) under reasonable maximum exposure (RME) and central tendency exposure (CTE) conditions. However, the text does not provide sufficient detail regarding the media, pathways, and COPCs driving

(contributing most significantly to) these cumulative risks and hazards. The text should be revised to provide medium-specific total risks and hazards and also identify pathway- and COPC-specific risks and hazards that are greater than or equal to 1E-06 and greater than 1, respectively.

APPENDIX RA SECTION 2.0 SPECIFIC COMMENTS

1. **Section 2.0, Page 2-2, Paragraph 2.** Bullet 8 in this paragraph refers to “Section 2.8: HHRA References.” No such section exists. All references for the entire risk assessment (including the ERA) are presented in Section 6.0. Therefore, Bullet 8 should be eliminated.
2. **Section 2.1, Page 2-4, Paragraph 0.** In discussing the Slag Pile, the text states that surface water runoff from the pile could flow into the LVR. The text also mentions that constituents in soil could leach to groundwater, which in turn is believed to discharge into the LVR. The text should be revised to mention two other potential transport mechanisms that may allow constituents from the Slag Pile to reach the LVR. First, constituents in slag already located in the LVR may leach directly into the LVR. Second, constituents in slag may leach to groundwater, which in turn is believed to discharge into the LVR.
3. **Section 2.1.1.1, Page 2-5, Footnote 1.** Footnote 1 includes the phrase “the surface soil dataset may no longer represent...” This phrase should be revised to read “the surface soil dataset may no longer represent...”
4. **Section 2.1.1.1, Page 2-6, Bullet 3.** This bullet discusses the current and future trespasser receptor at OU1. The first sentence states, “Perimeter fencing, security measures, and a lack of ‘attractive nuisances’ generally preclude trespassers from accessing the Carus Plant.” To clarify the extent and likelihood of any trespassing at the Carus Plant, the text should be revised to discuss if trespassing has in fact ever been observed at the Carus Plant and if so, where and how frequently.
5. **Section 2.1.1.2, Page 2-8.** According to the table of contents, Section 2.1.1.2 presents the potential receptors and exposure points for OU2. The first part of this section is jumbled and clearly missing some text. Section 2.1.1.2 should be revised to include all relevant text as provided by SulTRAC.
6. **Section 2.1.2, Page 2-10, Paragraph 1.** This section title is presented in standard font but should be revised to bold font consistent with other section titles.

7. **Section 2.1.2.1, Page 2-12, Paragraph 1.** With regard to vapor intrusion modeling, the text includes the citation “CalEPA (2005).” However, in Section 6.0, this reference is presented as “DTSC 2005.” Section 2.1.2.1 should be revised to cite the reference as “DTSC (2005).”
8. **Section 2.2.1.2, Page 2-15, Paragraph 3.** The text states, “At each well, the most recent result for a given parameter was selected as the representative concentration.” This approach may not necessarily be health-protective. For example, groundwater concentrations at the Matthiessen and Hegeler Zinc Company Site have shown some seasonal variation. Therefore, the most recent result may represent a lower concentration than measured during a previous sampling event. For OU1, representative groundwater concentrations should be selected as the maximum concentration based on at least the last four quarters of sampling results and at most the last 2 years of sampling results. This approach will help ensure that seasonal variation is taken into consideration. The text in Section 2.2.1.2 should be revised to reflect this new approach, and the text, tables, and figures throughout Appendix RA and Sections 7 through 9 of the RI report should be revised as needed to reflect this new approach.
9. **Section 2.2.1.3, Page 2-16, Paragraph 2, Bullet 1.** Bullet 1 presents the sediment data set. Item ii in this bullet refers to “two samples collected by Geosyntec in 1994.” However, no reference citation is provided for this statement. The text in Section 2.2.1.3 (and elsewhere in the risk assessment) should be revised as needed to provide a citation for the source of the “two [sediment] samples collected by Geosyntec in 1994.”
10. **Section 2.2.4.2, Page 2-23, Paragraph 2.** The last sentence in this paragraph ends with the phrase “. . . and the OU-specific results of background comparisons are presented in Appendix RA-2.” This statement is not entirely accurate. Appendix RA-2 includes only the results of background comparisons for OU2. The text should be revised to clarify that background comparisons for OU1 are not presented in Appendix RA-2 and to state where the OU1 background comparisons are presented.
11. **Section 2.2.5.1, Page 2-24, Paragraph 3.** All medium-specific COPCs are introduced except the COPCs for fish tissue. The text should be revised to include an introduction for the fish tissue COPCs.
12. **Section 2.3.1.3.2, Page 2-32, Paragraph 2.** This paragraph contains numerous errors. First, Carus Plant shallow groundwater exposure point concentrations (EPC) are presented in Table G3.1.4 and not Table G3.1.2. Second, Carus Plant shallow and deep groundwater EPCs are presented in Table

G3.1.3 and not Table G3.1.4. Third, Slag Pile shallow groundwater EPCs are presented in Table G3.2.4 and not Table G3.2.3. Fourth, Slag Pile shallow and deep groundwater EPCs are presented in Table G3.2.3 and not Table G3.2.4. The text should be revised as needed to refer to the correct table numbers.

13. **Section 2.3.2.1.1, Page 2-34, Paragraph 1.** The text states, “After employing the first tier [a default RBA of 1.0] a[t] OU1, a literature-derived arsenic bioavailability factor of 14% was developed from the primate studies of mining and smelting soils (Roberts et al. 2007).” Based on a calculation check of the OU1 exposure calculations, it appears that all numerical incidental ingestion of soil results for arsenic are based on the use of a relative bioavailability (RBA) value of 14 percent. As described in the Consensus Document (Appendix RA-1), calculations should first be performed using a default RBA value of 1.0. Then, if results are significant, site- and medium-specific RBAs can be used in follow-up calculations. The quoted text suggests that the first-tier use of a default RBA of 1.0 was conducted. However, the text does not indicate the location of these initial calculations in Appendix RA. The text should be revised to indicate where these calculations are presented.

Also, it appears that the RBA value of 14 percent has been applied to all soil and sediment calculations at the Carus Plant, Slag Pile, and LVR exposure areas. However, the studies upon which the selected RBA value are based apply to soils at smelting sites and apply most directly to soil from the Slag Pile. However, the characteristics of soil at the Carus Plant and sediment at the LVR may be different from soil at the Slag Pile. Therefore, the RBA value of 14 percent should not be applied to soil at the Carus Plant or sediment from the LVR unless it can be demonstrated that the characteristics of the soil and sediment at the Carus Plant and the LVR are sufficiently similar to soil at the Slag Pile and to the soils at smelting sites upon which the selected RBA value is based. If this demonstration cannot be made, the soil and sediment calculations at the Carus Plant and the LVR should be based on the default RBA value of 100 percent (1.0).

Finally, Section 2.3.2.1.1 should be revised to include a tie-in to the discussion of the range of RBA values (6.3 to 42 percent) calculated for OU2 (see Section 2.6.3.3) Based on this range, the use of a RBA value of 14 percent may underestimate exposures even for soils associated with smelting operations.

14. **Section 2.3.2.4, Page 2.45, Paragraph 1.** The text states that chemical speciation data was not collected from fish tissue samples collected from the LVR to assess the form of arsenic. However, the text goes on to discuss how the fraction of arsenic likely is present in the organic chemical

arsenobetaine and that the fraction of inorganic arsenic (the form upon which the toxicity factors used in the risk assessment are based) is expected to be 27 percent or less. Section 2.6.2.6.1 states that a value of 10 percent was selected as the percentage of inorganic arsenic in the fish fillet data. The text should be revised to clarify that the exposure calculations presented in the OU1 Risk Assessment Guidance for Superfund (RAGS) Table 7s (Appendix RA-G1) were initially performed assuming 100 percent inorganic arsenic. Any alternate percentage should be presented consistently throughout the risk assessment (Sections 2.3.2.4 and 2.6.2.6.1 should be consistent) and any additional calculations based on this alternate percentage should be presented as part of the uncertainty discussion, unless and until site-specific arsenic speciation results are available.

15. **Section 2.3.3.5.2, Page 2-56, Paragraph 0, Bullet 5.** This bullet states that an exposure duration (ED) of 25 years is the default RME value. This statement is incorrect – the correct value is 30 years (see the Consensus Document – Appendix RA-1 to the risk assessment). The text should be revised accordingly.
16. **Section 2.3.3.6.3, Page 2-65, Paragraph 0, Bullet 1.** This bullet states that an ED of 25 years is the default RME value. This statement is incorrect – the correct value is 30 years (see the Consensus Document – Appendix RA-1 to the risk assessment). The text should be revised accordingly.
17. **Section 2.3.3.7.1, Page 2-67, Paragraph 0, Bullet 6.** This bullet states that residents are assumed to be on site continuously. Therefore, an exposure time (ET) of 24 hours was used. However, in evaluating potential exposure to constituents in outdoor air under CTE conditions, an ET value of 3 hours was assumed (see the Consensus Document – Appendix RA-1 and Tables G4.10a.CTE and S4.9a.CTE in Appendix RA-G1). The text should be revised accordingly.
18. **Section 2.3.3.7.2, Page 2-72, Paragraph 0, Bullet 3.** This bullet states that an ET value of 2 hours per day was used under both RME and CTE conditions and only as part of the chronic daily exposure (CDE) equation for inhalation. The statement is correct in that the term ET is used only in the CDE equation for inhalation. However, as presented in Tables G4.11a.RME, G4.11a.CTE, S4.10a .RME, and S4.10a.CTE, ET values of 24 hours per day and 3 hours per day were used under RME and CTE conditions, respectively. The text should be revised accordingly.
19. **Section 2.3.3.7.2, Pages 2-74 and 2-75.** The text on Pages 2-74 and 2-75 present the equations and assumptions used to calculate the following parameters:
 - Age-adjusted dermal contact factor for inorganics (DFGWadj)

- Mutagenic DFGWadj (DFGW[M]adj)
- Age-adjusted dermal contact factor for organics – GW ($ET \leq t^*$) (DFGWadj01)
- Mutagenic DFGWadj01 (DFGW[M]adj01)
- Age-adjusted dermal contact factor for organics – GW ($ET > t^*$) (DFGWadj02)
- Mutagenic DFGWadj02 (DFGW[M]adj02)

The values presented for each of these parameters under RME conditions are correct. However, the values presented for each of these parameters under CTE conditions are incorrect. The correct CTE values for each of these values are presented below. All values have units of square-centimeters-hour-year per kilogram-event ($\text{cm}^2\text{-hr-yr/kg-event}$).

• DFGWadj	=	1,064
• DFGW[M]adj	=	5,225
• DFGWadj01	=	1,891
• DFGW[M]adj01	=	9,183
• DFGWadj02	=	1,064
• DFGW[M]adj02	=	5,225

The text and associated tables should be revised to present these values.

20. **Section 2.3.3.7.5, Pages 2-78 and 2-79.** Section 2.3.3.7.5 presents the adult age exposure factors. The descriptions of values selected for some of these parameters (for example, the sediment ingestion rate [IRSED]) do not include reference citations when the selected values are based on guidance and not on professional judgment. The text should be revised as needed to include all applicable reference citations.
21. **Section 2.3.3.7.5, Page 2-79, Paragraph 0, Bullet 4.** This bullet states that an ED of 25 years is the default RME value. This statement is incorrect – the correct value is 30 years (see the Consensus Document – Appendix RA-1 to the risk assessment). The text should be revised accordingly.
22. **Section 2.3.3.8.3, Page 2-82, Paragraph 0, Bullet 5.** This bullet states that an ED of 25 years is the default RME value. This statement is incorrect – the correct value is 30 years (see the Consensus Document – Appendix RA-1 to the risk assessment). The text should be revised accordingly.
23. **Section 2.5.2.1.2, Page 2-96, Paragraph 2.** The text presents risks and hazards for future commercial/industrial workers at the Carus Plant. The text states that if ingestion of groundwater

were eliminated (for example, if the pathway remains incomplete), “no unacceptable RME non-cancer risks would be identified” for this receptor under the RME scenario. Although it is true that no COPC-specific hazards exceed 1, the total hazard for potential exposure to subsurface soil is 1.2 and exceeds 1. The text should be revised to identify this hazard.

24. **Section 2.5.2.1.4, Page 2-99, Paragraph 3.** The text states that the cumulative HI is 51 under the RME scenario. The text also should be revised to state that this cumulative HI is based on total HIs of 20 and 31 for subsurface soil and groundwater, respectively.
25. **Section 2.5.2.1.4, Page 2-100, Paragraph 2.** The text states that the cumulative HI is 38 under the CTE scenario. The text also should be revised to state that this cumulative HI is based on total HIs of 7.1 and 31 for subsurface soil and groundwater, respectively.
26. **Section 2.5.2.1.5, Page 2-101, Paragraphs 3 through 6.** The text states that the cumulative RME HIs, including surface soil and subsurface soil, are 8,600 and 8,500, respectively. The text should be revised to specify the surface soil and subsurface soil total HIs of 132 and 56, respectively.

Similarly, the text states that the cumulative CTE HIs, including surface soil and subsurface soil, are 2,900 and 2,900, respectively. The text should be revised to specify the surface soil and subsurface soil total HIs of 62 and 27, respectively.

27. **Section 2.5.2.1.5, Page 2-102, Paragraphs 2 through 5.** These paragraphs present the carcinogenic risks for the aggregate resident under both RME and CTE conditions. However, the text focuses on a discussion of total carcinogenic risks. The text should be revised to also provide medium-specific total carcinogenic risks greater than 1E-06 for all media. Also, for each identified medium-specific total risk, the text should identify the COPCs associated with cancer risks greater than or equal to 1E-06.
28. **Section 2.5.2.2.1, Pages 2-108 and 2-109, Paragraphs 3 through 5 and 0 through 1.** The text presents cumulative cancer risks and HIs under RME and CTE conditions. However, the text does not provide sufficient detail (compared to the preceding RME discussion). The text should be revised to provide medium-specific total risks and hazards and also should identify COPC-specific risks and hazards that are greater than or equal to 1E-06 and greater than 1, respectively.
29. **Section 2.5.2.2.4, Pages 2-113 and 2-114, Paragraphs 3 through 5 and 1 through 3.** The text presents cumulative cancer risks and HIs under RME and CTE conditions. However, the text does not provide sufficient detail (compared to the preceding RME discussion). The text should be revised

to provide medium-specific total risks and hazards and also should identify COPC-specific risks and hazards that are greater than or equal to 1E-06 and greater than 1, respectively.

APPENDIX RA SECTION 3.0 SPECIFIC COMMENTS

1. **Section 3.1.1.1.3, Page 3-5, Paragraph 1.** This paragraph describes the floodplain within the LVR and notes that 31.5 acres of the Matthiessen and Hegeler Zinc Company Site are within the 100-year floodplain. The area identified as floodplain should be included in a figure, and the text should refer to that figure.
2. **Section 3.1.1.1.3, Page 3-6, Paragraph 1.** The last sentence in this paragraph states that monitoring of the macroinvertebrate community conducted by the Illinois Environmental Protection Agency (IEPA) at the southern boundary of OU1 indicated a generally abundant and diverse community. No reference citation is provided for this statement. Either the text should provide a reference citation and a reference, or the statement should be removed.
3. **Section 3.1.2.1.1, Page 3-11, Paragraph 1, and Figure RA-G3-2.** The text identifies the receptors observed at OU1 and notes that plants are receptors. However, plants are not included in the conceptual site model (CSM) depicted in Figure RA-G3-2. This receptor must be added to the CSM and identified as a complete exposure pathway. Also, Figure RA-G3-2 should be revised to define the acronyms “ASO” and “CSO” in the footnotes.
4. **Section 3.2.2.1.2, Page 3-20, Paragraph 2, and Table RA-G3-3.1.** This paragraph contains the hazard quotient (HQ) results for the Slag Pile. The result for chromium is listed as 2.1. However, the information in Table RA-G3-3.1 lists an HQ for chromium of 1.9. The text and table should be revised as needed to resolve this discrepancy.
5. **Section 3.4.1, Page 3-38, Bullet 1.** This bullet provides the rationale for not conducting a BERA for the Slag Pile at OU1. The last statement states that the physical substrate creates a poor habitat for ecological receptors. Although the substrate is not ideal, large portions of the Slag Pile Area are vegetated and support a number of ecological receptors. In addition, these portions of the Slag Pile contain complete exposure pathways. Either the last sentence in this bullet should be deleted or else text should be added to note that although portions of the Slag Pile are poor habitat, other areas contain established vegetation and exposure of ecological receptors is occurring and will continue to occur in these areas.

APPENDIX RA SECTION 4.0 GENERAL COMMENTS

1. The BERA for OU1 focuses on receptors in the LVR. In the evaluation of potential impacts to the macroinvertebrate and fish communities in the LVR, the BERA only evaluates results of the indices of biotic integrity (IBI) to assess the overall health of these communities. In order to fully evaluate the potential impacts, it is important that a full weight-of-evidence evaluation be made. For OU1, this evaluation should include an assessment of the chemical and physical conditions observed in LVR sediment and surface water samples. IEPA guidance for the interpretation of the IBI results (IEPA 2005) clearly states, “Successful interpretation and use of biological indicators requires corresponding information on the physical and chemical settings in which aquatic organisms live; in this way, biological measures, such as an Illinois fish-IBI score, complement rather than replace the utility of more-traditional physicochemical measures.” The inclusion of this type of information in the BERA will present a more complete picture of the potential and observed risks.

APPENDIX RA SECTION 4.0 SPECIFIC COMMENTS

1. **Section 4.1.1.1, Page 4-4, Paragraph 1.** As noted in the Section 4.0 General Comments, General Comment No. 1, the BERA should include the physical and chemical conditions observed in LVR sediment and surface water samples as part of its weight-of-evidence evaluation of potential risks to the macroinvertebrates and fish communities.
2. **Section 4.1.2.1, Page 4-6, Bullets 1 and 2.** As noted in the Section 4.0 General Comments, General Comment No. 1, the BERA should include the physical and chemical conditions observed in LVR sediment and surface water samples as part of its weight-of-evidence evaluation of potential risks to the macroinvertebrates and fish communities.
3. **Section 4.1.2.2.1, Page 4-7, Paragraph 3.** The text describes the study design for evaluating the macroinvertebrate and fish communities in the LVR. As noted in the Section 4.0 General Comments, General Comment No. 1, the BERA should include the physical and chemical conditions observed in LVR sediment and surface water samples as part of its weight-of-evidence evaluation of potential risks to the macroinvertebrates and fish communities. In addition, it is expected that more representative concentrations will be used in this evaluation than the maximum concentrations. Finally, the data should be presented to correspond to the sampling locations for both fish and macroinvertebrates. It is anticipated that the sediment data will also be presented for each macroinvertebrate sampling location for the east and west sides of the LVR.

4. **Section 4.1.2.2.2, Page 4-9, Paragraph 1.** A reference citation and reference should be provided for the equation used to model the average daily dose.
5. **Section 4.1.5.1, Page 4-17, Paragraph 4.** This section discusses the results of the macroinvertebrate IBI for each sampling station. The text should note that the lowest IBI scores were for locations next to the Slag Piles and that an impact was observed, even though the impact was not sufficient to lower the scores below the impairment threshold of 41.8.

APPENDIX RA SECTION 5.0 GENERAL COMMENT

1. Section 5.0 should be revised as necessary to reflect all revisions made in response to the specific and general comments above on the preceding risk assessment sections.

APPENDIX RA SECTION 6.0 GENERAL COMMENT

1. Various references cited in text do not appear in the reference list in Section 6.0. Examples of missing references (and the pages they are cited on) include Buchet et al. 1994 on Page 2-45, EPA 1990 on Page 2-133, Tetra Tech 1996 on Page 2-45, USGS 1994 on Figure RA-1-1, USDA NAIP 2007 on Figure RA-1-2, and WHO 1991 on Page 2-272. These examples should not be assumed to reflect all missing references. The risk assessment should be thoroughly reviewed to ensure that all references cited in the text are included in Section 6.0 and vice versa.

APPENDIX RA SECTION 6.0 SPECIFIC COMMENTS

1. **Section 6.0, Page 6-6.** References EPA 2009e through 2009h represent comment letters and memoranda prepared by EPA. However, all of these references lack important specific details, such as the author, organization, and subject of these documents. All four of these references should be revised to provide this important information.
2. **Section 6.0, Page 6-7.** The references for Geosyntec 2007 and 2009 represent Phase I and Phase II RI reports prepared for the Matthiessen and Hegeler Zinc Company Site. In order to aid readers in locating these documents, report dates should be added to both of these references.

APPENDIX RA-2 SPECIFIC COMMENT

1. **Table RA-2-1.** Table RA-2-1 presents summary statistics for background soil. The far right column of this table has been cut off. Table RA-2-1 should be revised so that all the information is presented in the table clearly and completely.

APPENDIX RA-G1 GENERAL COMMENTS

1. The tables of raw data only provide averages for subsurface soil when multiple depths were sampled at an individual location. Averages are also reported for LVR surface water when multiple sampling events occurred at an individual location. This presentation approach precludes independent verification of selected summary statistics in the RAGS Tables 2s and 3s in Appendix RA-G1. Also, the footnotes do not indicate how averages were calculated when both detected and non-detect results are presented (or how qualifiers were assigned to the averages in these cases). Additionally, it is unclear whether the maximum detected concentrations were determined before or after the averages were calculated. Use of averages for selected locations introduces unknown bias to calculations of the mean, standard deviation, and 95 percent upper confidence limit (95UCL). The footnotes for RAGS D Tables 2s and 3s should be revised as needed to address these issues and clearly explain how summary statistics were prepared. Also, a discussion of the decisions (and ramifications) of this approach should be provided as part of the uncertainty analysis.
2. The footnotes in the RAGS Table 3s indicate that calculation of the mean for samples with detected and censored results used surrogate values equal to one-half the reporting limit (RL) for the censored data. Use of simple substitution is not recommended in these cases, and it is suggested that the Kaplan-Meier means from the ProUCL output are a more appropriate estimation method. The RAGS D Table 3s should be revised accordingly.
3. The documentation for ProUCL indicates that one of the changes incorporated in the Version 4.00.04 update is reduced reliance on lognormal-based UCL methods. The recommendations or “decision rules” for method selection in Version 4.00.04 substitute the Chebyshev (Mean, Std) for the MVUE Chebyshev method in all situations where the MVUE method was previously recommended (see Table 9 of the Technical Guide). In a small number of cases in the RAGS D Table 3s, results for the MVUE Chebyshev method are used as the EPCs. Review of the ProUCL output indicates that this approach is recommended by the software. It is unclear whether this is an error in the software, but this outcome is contradicted by the discussion and recommendations in the User and Technical guides that accompany ProUCL 4.00.04. The RAGS D Table 3s (and associated exposure, risk, and hazard results) should be revised to report the result consistent with the recommendations in the User and Technical guides or additional justification and explanation for the approach used should be provided. If the latter option is chosen, a discussion of the impact of using the result consistent with the User and Technical guides on the exposure, risk, and hazard results should be included as part of the OU1 uncertainty discussion (see Section 2.6.2).

4. Various tables refer to the location of chemical-specific RBAs as the “Table 5 Series.” However, no chemical-specific RBA values are included in the Table 5 Series. The tables should be revised as needed to clearly direct the reader to the location or source of the chemical-specific RBA values.

APPENDIX RA-G1 SPECIFIC COMMENTS

1. **Table G2.4.** The column header incorrectly identifies the human health screening levels (HHSL) as “Surface Water HHSL.” The column header should be revised to read “Groundwater HHSL.”
2. **Table G4.4b.CTE.** The table lists the averaging time for noncarcinogens (ATnc) as 91 days. However, as noted in the text, the correct ATnc value is 41 days under the CTE scenario. The table (and associated calculation values) should be revised accordingly.
3. **Table G4.6a.CTE.** Under the inhalation exposure route, the exposure frequency (EF) is presented as 43 days per year. However, as noted in the text, the correct EF value is 21 days per year under the CTE scenario. The table should be revised accordingly.
4. **Table G4.10a.RME.** Under the ingestion of produce exposure route, the parameter ED is missing. As discussed in text, the correct ED value is 6 years under the RME scenario. The table should be revised accordingly.
5. **Table G4.10b.CTE.** Under the ingestion of groundwater exposure route, the conversion factor – water (CFdw) is incorrectly presented as 1.0E+03 milligram per microgram (mg/μg). The correct value is 1.0E-03 mg/μg. The table should be revised accordingly.
6. **Tables G4.11a.RME and G4.11a.CTE.** The equation for the ingestion of produce exposure route incorrectly includes the term ED. As shown in the footnotes to the tables, the ED term has been incorporated into the age-adjusted produce ingestion rates. Therefore, the equation should be revised to remove the ED term from the equation.
7. **Table G4.11a.CTE.** The table (and all associated calculations and text) should be revised as needed to address the errors summarized below.
 - The age-adjusted dermal contact factor – soil (DFSadj) is presented as 241 milligrams-year per kilogram-day (mg-year/kg-day). This value is incorrect. The correct value is 47.2 mg-year/kg-day according to Footnote 6. Note the comment on Footnote 6 presented below.
 - The mutagenic DFSadj factor (DFSMadj) is presented as 1,246 mg-year/kg-day. This value is incorrect. The correct value is 246 mg-year/kg-day according to Footnote 7. Note the comment on Footnote 7 presented below.

- The ET factor is presented as 24 hours per day. The correct value as discussed in the text is 3 hours per day. Also, Footnote 11 should be revised to explain that this value is based on best professional judgment.
- The age-adjusted aboveground produce ingestion rate parameter (CRagadj) is presented as 3.59E-02 year-kilogram dry weight per kilogram-day (yr-kg DW/kg-day). This value is incorrect. The correct value as presented in the text is 1.64E-02 yr-kg DW/kg-day.
- The mutagenic CRagadj parameter (CRaga[M]adj) is presented as 1.14E-01 yr-kg DW/kg-day. This value is incorrect. The correct value as presented in the text is 8.1E-02 yr-kg DW/kg-day.
- The age-adjusted belowground produce ingestion rate parameter (CRbgadj) is presented as 4.74E-03 yr-kg DW/kg-day. This value is incorrect. The correct value as presented in the text is 1.83E-03 yr-kg DW/kg-day.
- The mutagenic CRbgadj parameter (CRbg[M]adj) is presented as 1.35E-02 yr-kg DW/kg-day. This value is incorrect. The correct value as presented in the text is 8.6E-03 yr-kg DW/kg-day.
- Footnote 6 begins with the term IRSadj. This term is incorrect. The correct parameter is DFSadj. Also, the soil-to-skin adherence factor (AF) used for the last third of the equation is 0.07 milligram per square centimeter (mg/cm²). This value also is incorrect. The correct value is 0.01 mg/cm² and corresponds to the EPA-recommended default adult CTE value.
- Footnote 7 begins with the term IRSadj. This term is incorrect. The correct parameter is DFSMadj. Also, AF value used for the last third of the equation is 0.07 mg/cm². This value is incorrect. The correct value is 0.01 mg/cm² and corresponds to the EPA-recommended default adult CTE value.

8. **Table G4.11b.CTE.** The table (and all associated calculations and text) should be revised as needed to address the errors summarized below.

- The age-adjusted dermal contact factor for inorganics – GW (DFGWadj) is presented as 2,414 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 1,064 cm²-hr-yr/kg-event according to Footnote 6.
- The mutagenic DFGWadj parameter (DFGW[M]adj) is presented as 7,475 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 5,225 cm²-hr-yr/kg-event according to Footnote 7.
- The age-adjusted dermal contact factor for organics – GW (ET≤t*) parameter (DFGWadjo1) is presented as 4,602 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 1,891 cm²-hr-yr/kg-event according to Footnote 8a.
- The mutagenic DFGWadjo1 parameter (DFGW[M]adjo1) is presented as 13,745 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 9,183 cm²-hr-yr/kg-event according to Footnote 9a.
- The age-adjusted dermal contact factor for organics – GW (ET>t*) parameter (DFGWadjo2) is presented as 2,414 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 1,064 cm²-hr-yr/kg-event according to Footnote 8b.
- The mutagenic DFGWadjo2 parameter (DFGW[M]adjo2) is presented as 7,475 cm²-hr-yr/kg-event. This value is incorrect. The correct value is 5,225 cm²-hr-yr/kg-event according to Footnote 9b.

9. **Table G4.16.CTE.** The table incorrectly presents the ATnc value as 10,950 days. The correct value is 3,285 days. The table should be revised accordingly.

APPENDIX RA-G3 GENERAL COMMENTS

1. Tables RA-G3-1.3 and RA-G3-2.3 are not listed in the table of contents list of Tables for this appendix. Also, Table RA-G3-4 is listed in the table of contents but is not included in Appendix RA-G3. Appendix RA-G3 should be revised to ensure that the table of contents list of Tables matches the tables included in the appendix and to ensure that all appropriate tables are included in the appendix.
2. Some results are listed as “Not Reported (NR),” assigned a surrogate value equal to the maximum RL, and assigned a “U” qualifier. The table footnotes should be revised to include additional text to clarify what is meant by NR results (for example, the sample was not analyzed, the result was not reported because of a laboratory error or omission, etc.) and to explain the rationale for assigning a U-qualified surrogate value. Also, the tables should include footnotes that explain the difference between results listed as NR versus results listed as “—.”

APPENDIX RA-G3 SPECIFIC COMMENT

1. **Table RA-G3-3.1.** This table presents the ProUCL output for the LVR sediment. It is unclear why some U-qualified results for metals and organics are reported as zero (rather than at a fixed RL or as NR, missing, etc.). The table should be revised as needed to clarify why some sediment results are reported as zero.

APPENDIX RA-G4 SPECIFIC COMMENTS

1. **Figure RA-G4-1.** The figure should be revised to define the acronyms “ASO” and “CSO” in the footnotes.
2. **Table RA-G4-4.** This table discusses exposure information for the mink and belted kingfisher. The equation used to determine the mink food ingestion rate is the equation for all mammals rather than the specific equation for carnivorous mammals. Because the mink was selected as the representative species for mammalian carnivores, the specific carnivore equation should be used in the calculations. Also, the equation used to determine the belted kingfisher food ingestion rate is the equation for all birds rather than the specific equation for avian carnivores. Because the belted kingfisher was selected as the representative species for avian carnivores, the specific carnivore equation should be

used in the calculations. In addition, all text, tables, and figures should be revised as needed to discuss the correct equation results.

Both equations used to determine the mink and belted kingfisher ingestion rates were dry-weight equations instead of wet-weight equations. The information in the “Wildlife Exposure Factors Handbook” (EPA 1993) is all wet-weight information. The text and tables of the RI report do not contain conversions from dry weight to wet weight. If the conversions were conducted, conversion equations should be included and discussed. If the conversions were not conducted, wet-weight ingestion rate equations should be used. In addition, all text, tables, and figures should be revised as needed to discuss the wet-weight equation results.

Finally, the mink daily water ingestion rate could not be calculated using the ingestion rate value listed in the notes. Also, the value in the notes does not equal the mean of ingestion rate values reported for mink (non-farm raised) in the “Wildlife Exposure Factors Handbook” (EPA 1993). Either the daily water ingestion rate should be recalculated using the value listed in the notes, or the mean ingestion rate from the “Wildlife Exposure Factors Handbook” should be reevaluated and possibly recalculated. In addition, all text, tables, and figures should be revised as needed to discuss the correct ingestion rate values.

3. **Table RA-G4-5.1.** This table lists the mammalian toxicity reference values (TRV). The copper no-observed adverse effect level (NOAEL) TRV listed is 25 mg/kg of body weight per day (bw/day), but the correct value is 5.60 mg/kg bw/day. This table and all tables that present the copper TRV should be revised as needed to present this correct value.
4. **Table RA-G4-5.2.** This table lists the avian TRVs. The copper NOAEL TRV listed is 18.5 mg/kg bw/day, but the correct value is 4.05 mg/kg bw/day. This table and all tables that present the copper TRV should be revised as needed to present this correct value.

APPENDIX RA-G5 SPECIFIC COMMENT

1. **Table RA-G5-2.1.** This table presents the Johnson and Ettinger inputs and assumptions for the resident. The indoor air exchange rate (ER) value used is 0.5 liter per hour (L/hr). No documentation is presented for this value. The EPA guidance “OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)” (EPA530-D-02-004) and EPA’s Advanced Groundwater (GW-ADV) Model for Vapor Intrusion into Buildings, Version 3.1, both recommend an ER value of 0.25 L/hr for the residential

scenario. The table should be revised to present an ER value of 0.25 L/hr, and all Johnson and Ettinger calculations should then be rerun using the new value.

APPENDIX RA-E-G2 SPECIFIC COMMENTS

1. **Section 2.3.1, Page 9, Paragraph 2.** This paragraph describes the IBI process and refers to Illinois Department of Natural Resources (IDNR)-established reference reaches to determine if the reaches attain a specific level to support aquatic life. The text should indicate if the threshold values are specific to the watershed containing the LVR or if the values are state-wide values. In addition, if the values are watershed- or region-specific, the text should be revised to discuss the region containing the LVR.
2. **Section 3.1.1, Page 17, Paragraphs 2 and 3.** These paragraphs describe the physical habitat conditions at CAR002 and CAR003. For both locations, the text states that the reach was determined to be near full recovery from past channel modifications and considered stable. It is not clear how this determination was made when the reach associated with CAR001 was considered to be in a recovery stage. The text should be revised to provide the rationale for conclusions regarding the recovery of the LVR at CAR002 and CAR003.
3. **Section 3.3.6, Page 28, CAR001.** The second sentence in the paragraph states that the range of scores expressed within the IEPA Integrity Class for “Good” is 52.7 to 72.9. The range is actually from 41.8 to 72.9. The text should be revised to present the correct range.
4. **Tables 3-19 through 3-27.** The macroinvertebrate IBI (mIBI) ranges listed in the tables do not match the ranges provided in the referenced documentation. The ranges should be adjusted to match the ranges in the referenced literature. In addition, all text, tables, and figures should be revised as needed to discuss the correct ranges.

REFERENCES

- Illinois Environmental Protection Agency (IEPA). 2005. “Interpreting Illinois Fish (fIBI) Scores (Draft).” Bureau of Water, Surface Water Section. Springfield, IL.
- U.S. Environmental Protection Agency (EPA). 1993. “Wildlife Exposure Factors Handbook.” Office of Research and Development. EPA-600-R-93-187. December.
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